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Description

[0001] The present invention relates to objects which should be prevented from being forged and are to be checked for authenticity, such as important documents, securities, paper money, checks, traveler's checks, bank cards, prepaid cards, ID cards, CD cards, credit cards, passports, art objects, and betting tickets for public-managed gambling games (e.g., horse racing and bicycle racing). The present invention also relates to a method and apparatus for checking the objects.

[0002] A checking method and apparatus utilizing microwaves are known in the art as measures for checking the authenticity of documents or the like, as described in PCT National Publication No. 63-501250 (i.e., U.S. Patent No. 4,820,912). An object to be checked, wherein stainless steel fibers are embedded and scattered in the sign panel of a card base member, is also known in the art, as described in Jpn. Pat. Appln. KOKAI Publication No. 5-270181.

[0003] According to these publications, microwaves are applied to a large number of metallic wires which are embedded and scattered at random in a document or a card, and a proper digital mark responsive to a response microwave bundle is recorded in a suitable region of the document or card according to specific rules. To check the authenticity of the document or card, microwaves are applied to the document or card, and a response microwave bundle is collated with the digital mark. The document or card is determined as being authentic when the microwave bundle and the mark agree with each other.

[0004] The checking means which utilizes microwaves, as in the apparatuses of the above publications has problems in that the measurement of a response microwave bundle is susceptible to external noise, and the signal-to-noise ratio (S/N ratio) is lowered thereby. In addition, the apparatuses of the publications may constitute a source of noise since they oscillate microwaves. Further, a microwave transmitter and a microwave receiver are generally large in size and entail high costs.

[0005] In the case where metallic wires are embedded in a thin object, such as paper, it is likely that the metallic wires will be exposed in the surface of the object. If this happens, the object does not look nice. In addition, the metallic wires prevent satisfactory printing or coloring from being performed with respect to the object, and may rust, depending upon the environment. Further, if the object is bent, the metallic wires embedded therein may break, protruding from the surface of the object. In the worst case, the code which is assigned to the object in the manufacturing process of the object changes into a different code, and the collation of the code of the card cannot be performed.

[0006] On the sign panel of a cash or credit card, a certain kind of data (e.g., a user's name) is written with a writing tool, such as a ball-point pen or a fountain pen.

Therefore, the sign panel should be white or whitish. However, if metallic wires, such as stainless steel wires, are embedded in the white or whitish sign panel, they may be externally observed. It should be also noted that the sign panel is thin and the metallic wires embedded in the sign panel may be exposed in the surface of the sign panel. Accordingly, the use of metallic wires is not desirable from the viewpoint of security.

[0007] Since metallic wires have a smooth surface, they may hinder a user's name or the like from being clearly written on the sign panel, or may become a cause of ink blotting. In addition, if a sign panel block containing metallic wires is cut into sign panels of desirable size by means of a cutter, the metallic wires may partially project from the faces along which the sign panel block is cut. Further, the cutter does not withstand long use.

[0008] If the metallic wires are thin, the problems mentioned above may be solved to a certain degree, but the use of thin metallic wires in no way provides a perfect solution to the problems. In addition, the use of thin metallic wires is not realistic since it results in both a poor S/N ratio and a high manufacturing cost.

[0009] US-A-4,114,032 discloses an object to be checked according to the precharacterizing part of claim 1 and a card-like object to be checked according to the precharacterizing part of claim 8. Additionally, this document discloses a method and an apparatus for checking the corresponding objects by scanning the objects (cards) and detecting the distribution of magnetic fibres in the cards. The detected distribution is compared with coded information on the card.

[0010] A further similar object, checking apparatus and method are known from US-A-4,218,674.

[0011] Accordingly, an object of the present invention is to provide a to-be-checked object which is free of the problems entailed in a to-be-checked object containing embedded metallic wires and which ensures a high degree of security and a high S/N ratio.

[0012] According to the present invention, there is provided an object to be checked according to claim 1 and a card-like object to be checked according to claim 8. The dependent claims are related to further advantageous aspects of the present invention.

[0013] The present invention provides a to-be-checked object comprising: a base member formed of a nonmagnetic material; a scanning region located at a specific portion of the base member; a plurality of magnetic polymer elements scattered at random in the scanning region and oriented in many and unspecified directions, each of the magnetic polymer elements including a flexible element main body formed of a high molecular material and a magnetic metal contained in the element main body; and a code indicator section for storing encoded information corresponding to an output which is produced in accordance with a state of the magnetic polymer elements scattered in the scanning region.

[0014] In a normal case, the code indicator section mentioned above is either a magnetically-readable re-

cording medium (e.g., a magnetic strip) or an optically-readable recording medium (e.g., a bar code). However, the code indicator section may be part of the memory of a host computer, if so desired.

[0015] Either powder of a magnetically-soft material having high magnetic permeability (such as Permalloy, Co-based amorphous material, soft ferrite or Sendust) or powder of a magnetically-hard material having high coercive force (such as ferrite, Sm-Co alloy, or Nd alloy), is suitable for use as the magnetic metal mentioned above. In the case where the magnetic metal is formed of powder of a material having high coercive force, the magnetic polymer elements can be magnetized beforehand.

[0016] The base member can be formed of paper, for example. Where the base member is formed of paper, the magnetic polymer elements are integrally incorporated in the base member together with the wood pulp fibers of the paper such that they are arranged at random and tangled together three-dimensionally. The high-molecular material used for forming the main bodies of the magnetic polymer elements is acrylic resin, for example. In some cases, it is preferable that the magnetic polymer elements formed of resin be covered with a coating layer having a similar color to that of the base member.

[0017] To achieve the objects, the present invention also provides a card-like to-be-checked object comprising: a card-like main body formed of a nonmagnetic material; and a sign panel which is located in a scanning region provided on at least part of the obverse or reverse side of the main body and on which a certain kind of data is to be written, the sign panel including a base member formed of paper and containing a large number of wood pulp fibers, and a plurality of fibrous magnetic polymer elements which are integrally incorporated in the base member together with the wood pulp fibers of the paper, each of the magnetic polymer elements including an element main body formed of a high molecular material and magnetic metal powder contained in the element main body, the card-like main body having a code indicator section for storing encoded information corresponding to a detection signal obtained in accordance with the distributed state of the magnetic polymer elements of the sign panel.

[0018] To check whether or not the object is authentic, an apparatus is known comprising: detection means for magnetically scanning the magnetic polymer elements incorporated inside the scanning region and for producing a detection signal peculiar to the object by detecting an output which varies in accordance with the distributed state of the magnetic polymer elements; means for producing a cipher code by ciphering the detection signal; code writing means for-recording the cipher code in the code indicator section of the object; reading means for reading the cipher code recorded in the code indicator section; and means for collating the cipher code read by the reading means with the detection signal produced

by the detection means and for determining that the object is authentic when the cipher code and the detection signal agree with each other.

[0019] A large number of magnetic polymer elements are incorporated in the scanning region of the object during the manufacturing process of the object, and a detection signal which is obtained by magnetically scanning the scanning region and which is peculiar to the object is utilized for determining whether or not the object is authentic.

[0020] To be more specific, the detecting means detects a detection signal which is produced in accordance with the distributed state of the magnetic polymer elements incorporated in the scanning region, with the object being moved at a predetermined speed.

[0021] Each time the scanning region is scanned by a very short distance, the detection signal varies in accordance with the density, sizes and orientated directions of the magnetic polymer elements. Therefore, the output pattern of the detection signal is specially characteristic of the scanning region.

[0022] When the object is manufactured, the detection signal is ciphered according to predetermined rules and recorded in the code indicator section.

[0023] In the process for checking whether or not the object is authentic, the scanning region is scanned again to obtain a detection signal characteristic of the scanning region, and the cipher code recorded in the code indicator section of the object is read. When the detection signal and the cipher code agree with each other, the object is determined as being authentic.

[0024] The magnetic polymer elements incorporated inside the object provided by the present invention are very soft in comparison with metallic wires. Even if the object is thin and is bent, the elements do not break or are not exposed in the surface of the object. Therefore, the surface of the object can maintain a state suitable for printing and coloring. In addition, since the elements do not rust, printing and coloring can be performed reliably. Further, the distribution pattern of the elements does not vary during use of the object.

[0025] Since, in the present invention, the magnetic polymer elements incorporated in the scanning region are magnetically detected, external noise from the apparatus does not become a problem, and the S/N ratio is high, accordingly.

[0026] In the case where the base member is formed of paper, the magnetic polymer elements are integrally incorporated in the base member together with the wood pulp fibers of the paper. Since, in this case, the magnetic polymer elements and the wood pulp fibers are arranged at random and tangled together three-dimensionally, the degree of integration of the magnetic polymer elements to the base member is high. Therefore, the magnetic polymer elements do not change in position inside the base member, separate from the base member, or form a burr on the surface of the base member. In short, the state of the magnetic polymer elements is very stable. In addition, the object incorporating such magnetic polymer elements withstands long use and

ensures a high degree of security. Since the base member can be cut into pieces of desirable sizes, and any data can be printed or written thereon, the object having such a base member can be used for a variety of purposes.

[0024] In the sign panel employed in the present invention, the magnetic polymer elements are integrally incorporated in the base member formed mainly of wood pulp fibers, and the wood pulp fibers and the magnetic polymer elements are tangled together three-dimensionally. Since it is practically impossible to tamper with the distributed state (particularly, the embedded depth) of the magnetic polymer elements in the sign panel, the object provided by the present invention ensures a high degree of security.

[0025] Since the magnetic polymer elements incorporated in the sign panel can be easily coated with a layer of desirable color (e.g., a white layer), they can be prevented from being externally observed. If a paper surface member is provided on the base member of the sign panel, the magnetic polymer elements can be reliably concealed. It should be also noted data can be freely written on the sign panel by using a writing tool or a stamp. Since the sign panel does not contain any metallic wire, it is free of the problem arising from rust. In addition, the sign panel can be easily cut into pieces of desirable sizes by means of a cutter, and the life and performance of that cutter are not adversely affected.

[0026] Even if the sign panel is detached from the object and a counterfeit sign panel pasted, this can be easily detected. In addition, since the magnetic polymer elements are prevented from being observed externally of the sign panel, the object provided by the present invention ensures a high degree of security.

[0027] The information which is determined by the distribution of the magnetic polymer elements incorporated in the sign panel is collated with the information recorded in the code indicator section, and the object is determined as being authentic only when the two pieces of information agree with each other. Therefore, the sign panel is very reliable, and is very effective in preventing an unauthorized person from forging an authorized person's signature, for illegal use of a credit card or the like.

[0028] This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a sectional view of a magnetic polymer element employed in a to-be-checked object according to the first embodiment of the present invention; FIG. 2 is a schematic plan view showing an example of a to-be-checked object;

FIG. 3 is a schematic sectional view showing an apparatus employed for manufacturing the magnetic polymer element depicted in FIG. 1;

FIG. 4 is a sectional view showing another example of an apparatus employed for manufacturing a magnetic polymer element;

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FIG. 5 is a partially-sectional side view showing a processing apparatus

FIG. 6 is a flowchart showing the steps used for manufacturing a to-be-checked object;

FIG. 7 is a flowchart showing the steps used for checking the object;

FIG. 8 is a partially-sectional side view showing a further processing apparatus;

FIG. 9 is a partially-sectional schematic side view showing a processing apparatus employed in the third embodiment of the present invention;

FIG. 10 is a sectional view showing another example of a magnetic polymer element incorporated in a to-be-checked object;

FIG. 11 is an enlarged view of a to-be-checked object and shows how magnetic polymer elements are integrally mixed with the wood pulp fibers of paper;

FIG. 12 is a sectional view showing an example of an apparatus used for manufacturing magnetic polymer elements formed of acrylic resin;

FIG. 13 is a sectional view showing part of the apparatus of FIG. 12 in an enlarged scale;

FIG. 14 is a sectional view showing a magnetic polymer element having a coating layer thereon;

FIG. 15 is a sectional view showing part of an apparatus employed for manufacturing the magnetic polymer element depicted in FIG. 14;

FIG. 16 is a graph showing an output produced from magnetic polymer elements having a length of less than 2 mm;

FIG. 17 is a graph showing an output produced from magnetic polymer elements having a length of 5 mm;

FIG. 18 is a graph showing the relationships between an output and the diameter of magnetic polymer elements;

FIG. 19 is a plan view showing another example of a to-be-checked object;

FIG. 20 is a side view of the object depicted in FIG. 19;

FIG. 21 is an enlarged sectional view showing the sign panel provided on the object depicted in FIG. 19;

FIG. 22 is a side view of a to-be-checked object for which a sign panel having a surface member is provided; and

FIG. 23 is an enlarged sectional view of the sign panel depicted in FIG. 22.

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[0029] The first embodiment of the present invention will now be described with reference to FIGS. 1 through 7.

[0030] As is shown in FIG. 2, a large number of magnetic polymer elements 12 are scattered at random in the base member 11 of an object 10 to be checked, such that the magnetic polymer elements 12 are oriented in many and unspecified directions. The base member 11 is formed of a nonmagnetic material, such as paper or

plastics. The magnetic polymer elements 12 are in the form of fibers. As can be seen from the cross section shown in FIG. 1, each magnetic polymer element 12 is made up of an element main body 13 formed of a high molecular material, and magnetic metal powder 14 contained in the interior of the element main body 13.

[0031] Examples of the high molecular material of the element main body 13 are polyethylene, polyester, urethane, etc. In other words, any known synthetic resin having flexibility can be used as the material of the element main body 13. Either powder of a magnetically-soft material having high magnetic permeability or powder of a magnetically-hard material having high coercive force is suitable for use as the magnetic metal powder 14.

[0032] An example of a method used for manufacturing the magnetic polymer elements 12 is shown in FIG. 3. The manufacturing method shown in FIG. 3 is a dry process employing a double-structure container 15. The double-structure container 15 has an outer chamber 15a and an inner chamber 15b. The outer chamber 15a contains a molten high molecular material 13a which is heated at a temperature of, for example, 200°C to 500°C and which is therefore in the molten state, while the inner chamber 15b contains a magnetic metal powder 14. The high molecular material 13a and the magnetic metal powder 14 are allowed to fall or forcibly pushed out from a nozzle 16. While the high molecular material 13a coming out from the nozzle 16 cools and hardens, the magnetic metal powder is incorporated inside the hardened high molecular material 13a.

[0033] Another example of a method used for manufacturing the magnetic polymer elements 12 is shown in FIG. 4. The manufacturing method shown in FIG. 4 is a wet process. In this wet process, a pipe 13b formed of a high molecular material and prepared beforehand is immersed in an alkaline solution 14a containing ions of a magnetic metal, thereby permitting the magnetic metal to be deposited on the inner face 13c of the pipe 13b.

[0034] The magnetic polymer elements 12 manufactured as above are incorporated in a scanning region 17 at a predetermined density during the manufacture of the object 10. Instead, a nonwoven fabric made of the magnetic polymer elements 12 and cut to have an appropriate size, may be embedded in the scanning region 17 of the object 10.

[0035] The magnetic polymer elements 12 shown in the drawings are in the form of fibers. However, they may be in the form of ribbons or foils. In addition, the cross section of the elements 12 need not have a circular shape; it may have a polygonal shape, a rectangular shape, an oval shape, or any other shape desired. The diameter D1 (or thickness) of the magnetic polymer elements 12 must be determined in accordance with the size of the object 10, but it is usually within the range of 5 to 50 µm. The particle diameter of the magnetic metal powder 14 is 1 µm or less, and the average particle diameter thereof is preferably within the range of 0.2 to

0.3 µm. The appropriate mixing ratio of the magnetic metal powder 14 is 40 to 70% by volume. It is desirable that the magnetic metal powder 14 be located in the center of the cross sectional plane of the element 14.

[0036] A code indicator section 18 is provided on the object 10. Encoded information which is peculiar to the object 10 and which corresponds to the state in which the magnetic polymer elements 12 are distributed in the scanning region 17, is recorded in the code indicator section 18 by means of a recording apparatus 20 described below.

[0037] Where powder of a magnetically-soft material having high magnetic permeability (such as Permalloy, Co-based amorphous material, soft ferrite, and Sendust) is used as the magnetic metal powder 14 mentioned above, the object 10 is magnetically scanned by the processing apparatus 20 shown in FIG. 5.

[0038] The processing apparatus 20 shown in FIG. 5 comprises a housing 25 and a conveyor mechanism 26. The conveyor mechanism 26 has object-conveying components 27, such as a belt and rollers, and conveys the object 10 at a constant speed in the direction indicated by arrow F in FIG. 5.

[0039] A pair of induced voltage-detecting coils 33, made up of an excitation coil 31 and a detection coil 32, are arranged in the moving path of the object 10. The excitation coil 31 and the detection coil 32 are provided on the core 41 of a detection head 40. The core 41 is formed of an alloy having high magnetic permeability, and has a gap 42.

[0040] A detection section 43 is located in the vicinity of the gap 42. The scanning region 17 of the object 10 is made to pass the detection section 43. A DC power supply circuit 45 for providing the core 41 with a DC bias magnetic field is connected to the excitation coil 31. When a current flows through the excitation coil 31, a certain number of magnetic fluxes pass through the core 41, and part of the bias magnetic field has a magnetic effect on the detection section 43. In the present embodiment, coil 32 is employed as a magnetic detector, but a magnetic detecting element, such as a Hall element, may be employed in place of coil 32.

[0041] The processing apparatus 20 comprises the following: a controller 50 incorporating a microcomputer or the like; a code write section 51 for recording a cipher code (which will be described below) in the code indicator section 18 of the object 10; and a code read section 52 for reading the cipher code recorded in the code indicator section 18. The code write section 51 and the code read section 52 are connected to a code read/write circuit 53. The controller 50 includes an analog-to-digital converter 60, a comparator 61, and a cipher code converter 62. A display 65 is connected to the controller 50.

[0042] A description will now be given of the operation of the apparatus 20 of the above embodiment.

[0043] FIG. 6 shows the outline of the process used for manufacturing the object 10. In step S1, magnetic polymer elements 12 are incorporated in the base mem-

ber 11 of the object 10 when the base member 11 is manufactured. In scanning & detection step S2 (which includes both scanning step S3 and detection step S4), the object 10 is moved at a predetermined speed in the direction of arrow F by means of the conveyor mechanism 26, and a detection signal which is peculiar to the object 10 and determined by the distribution of the elements 12 inside the scanning region 17 is obtained.

[0044] In scanning step S3, the DC power supply circuit 45 supplies a DC current to the excitation coil 31, thereby applying a bias magnetic field to the core 41. When no magnetic polymer element 12 is present at the detection section 43 of the core 41, the magnetic permeability of the gap 42 remains in the initial state, and the number of magnetic fluxes passing through the core 41 is constant. Since, in this case, a voltage due to electromagnetic induction is not generated in the coil 32, the voltage output from the controller 50 is substantially zero.

[0045] When the scanning region 17 of the object 10 passes the detection section 43, with the object 10 being moved at the predetermined speed in the direction of arrow F by means of the conveyor mechanism 26, a number of minute portions of the scanning region 17 sequentially pass the detection section 43. At the time, the magnetic permeability of the gap 42 varies with time in accordance with the distribution of the magnetic polymer elements 12 incorporated in each minute portion of the scanning region 17, and the number of magnetic fluxes passing through the core 41 varies. As a result, a voltage due to electromagnetic induction is generated in the detection coil 32.

[0046] Since the induced voltage greatly varies in level in accordance with the density, diameter (thickness), length and orientated directions of the magnetic polymer elements and further with the characteristics of the magnetic metal powder 14, the induced voltage can be measured as an output voltage pattern peculiar to the object 10. In the present embodiment, the scanning region 17 is scanned at the intervals of very short times, and output voltages corresponding to the very short times are ranked in a number of stages, for digitization. In this manner, an encoded detection signal peculiar to the scanning region 17 is obtained. If the magnetic polymer elements 12 are manufactured such that the amounts of magnetic metal powder 14 contained in them are nonuniform, a wide variety of output patterns can be obtained.

[0047] In enciphering step S5, the detection signal is converted into a cipher code according to specific rules by means of the cipher code converter 62. In recording step S6, the cipher code is recorded in the code indicator section 18 by means of the magnetic head of the code write section 51. In this embodiment, the code indicator section 18 is a magnetic strip, and the cipher code is magnetically recorded in the magnetic strip. However, the cipher code may be printed on the code indicator section 18 as an optically-readable mark or code (such

as a bar code, a two-dimensional bar code, or an OCR character) by means of a printing head. Alternatively, holograms in which predetermined codes are recorded may be sequentially stamped in accordance with the cipher code. Further, the cipher code may be stored in the code storage area of the host computer.

[0048] The processing apparatus 20 mentioned above is also used for checking whether or not the object 10 is authentic. FIG. 7 shows the outline of the collation process for checking the authenticity of the object 10. Step S11 of this collation process includes scanning step S3 and detection step S4 which are similar to those of the manufacturing process of the object 10, and a detection signal determined by the distribution of the magnetic polymer elements 12 is obtained by scanning the scanning region 17 at the predetermined speed.

[0049] In code read step S12 of the collation process, the cipher code recorded in the code indicator section 18 is read by means of the code read section 52. The read cipher code is decoded according to predetermined rules by means of the cipher code converter 62, thus obtaining a code for collation. In determination step S14, this code is collated with the detection signal detected by the detection step S4, by means of the comparator 61. The object 10 is determined as being authentic by the comparator 61 only when the code and the detection signal agree with each other, and the results of collation are indicated on the display 65.

[0050] The processing apparatus 20 can reliably read the scanning region 17 even when the external magnetic field applied to the object is not intense. Therefore, the cipher code or other kinds of information which are magnetically recorded in the code indicator section 18 or other portions of the object 10, are not destroyed by the external magnetic field. It should be also noted that the processing apparatus 20 is not easily affected by external noise since an induced voltage is detected by means of the detection coil 32 and the core 41 having the gap 42.

[0051] In the case where the cipher code is recorded in the code storage area of the host computer in the manufacturing process of the object 10, the cipher code may be read from the host computer and collated with the detection signal in the collation process. Alternatively, in the collation process, the detection signal obtained in detection step S4 may be converted into a cipher code according to the same rules as those of the manufacturing process, and the cipher code, thus obtained, may be collated with the cipher code read in the code read step S12.

[0052] In the case where the magnetic metal powder 14 is formed of a material having high coercive force, i.e., a magnetically-hard material, such as ferrite, Sm-Co alloy, and Nd alloy, the magnetic polymer elements 12 can be magnetized beforehand. Since, in this case, the magnetic polymer elements 12 generate magnetic fluxes at all times, the authenticity of the object 10 can be checked by means of a simple processing apparatus 68,

such as that shown in FIG. 8. Since the processing apparatus 68 shown in FIG. need not employ the DC power supply circuit 45 or the coil 31 mentioned above, its structure can be simplified, accordingly.

[0053] In the embodiments mentioned above, the magnetic polymer elements 12 used in the object 10 are very soft and flexible, and do not break even if they are bent. In the case where the magnetic polymer elements 12 are incorporated in a thin object 10, such as an object formed of paper, the elements 12 do not break or are not exposed from the surface of the object 10 even if the object 10 is bent. In addition, the pattern given to the object 10 during the manufacturing process is not altered even if the object 10 is bent.

[0054] The magnetic polymer elements 12 can be easily colored by known coloring means since the element main bodies 13, i.e., the outer portions of the elements 12, are formed of a high molecular material. Even if part of the elements 12 should be exposed from the surface of the object, such elements do not become an obstacle to printing or coloring and can therefore be concealed. In the case where the object 10 is formed of paper, the elements 12 incorporated in the object 10 cannot be observed externally, thus providing a high degree of security.

[0055] A processing apparatus 70 according to another embodiment to be used for an object according to the invention will be described with reference to FIG. 9. In FIG. 9, the structural elements which are similar to those of processing apparatus 20 of the above-described embodiment are denoted by the same reference numerals as used in FIG. 5, and explanation of such elements will be omitted herein. Therefore, the following descriptions are limited to the structural elements which are unique to processing apparatus 70.

[0056] In the processing apparatus 70 shown in FIG. 9, a magnetic sensor 73 is located at an intermediate position of the moving path of the object 10. The magnetic sensor 73 employs first and second MR (magnetoresistor) elements 71 and 72 as a pair of magnetoelectric transducers. The first and second MR elements 71 and 72 are arranged in the moving direction of the object 10 (i.e., in the scanning direction). The magnetic sensor 73 also employs a magnet 74 (i.e., a magnetic field generating means) located behind the MR elements 71 and 72. The magnet 74 may be either a permanent magnet or an electromagnet having an electromagnetic coil.

[0057] The MR elements 71 and 72 are magnetoresistor elements whose electrical resistances vary in accordance with the intensity of the magnetic field applied thereto. Either magnetoresistor elements having positive magnetic characteristics (e.g., elements formed of a compound semiconductor, such as indium antimonide or gallium arsenide) or magnetoresistor elements having negative magnetic characteristics (e.g., elements formed of a ferromagnetic material, such as nickel-cobalt or Permalloy) are used in accordance with the spec-

ifications required.

[0058] The first and second MR elements 71 and 72 are connected together and are arranged such that the magnetic field generated by the magnet 74 acts on them with the same intensity. The first MR element 71 is connected through a detection circuit 75 to a controller 50, while the second MR element 72 is connected to a DC power supply circuit 45. The object 10 is moved such that its scanning region 17 travels in the direction in which the MR elements 71 and 72 are arranged.

[0059] When the scanning region 17 of the object 10 passes through the region under the MR elements 71 and 72, output voltage V_{out} varies in accordance with the distribution of the magnetic polymer elements 12 coming into that region. To be more specific, when the magnetic polymer elements 12 are not present in the vicinity of the MR elements 71 and 72, the magnetic field generated by the magnet 74 uniformly acts on the MR elements 71 and 72. Since, in this case, the MR elements 71 and 72 are equal to each other in resistance, output voltage V_{out} is approximately one half ($V_{in}/2$) of input voltage V_{in} . When the magnetic polymer elements 12 move in the direction of arrow F and come into the region under the MR elements 71 and 72, the magnetic fluxes passing through each of the MR elements 71 and 72 vary with time in accordance with the position, density, diameter, length, orientated directions and embedded depth of the magnetic polymer elements 12 and further with the characteristics of the magnetic metal powder 14. In addition, a difference is produced between the resistance of one MR element and that of the other. As a result, output voltage V_{out} increases or decreases, with the level of $V_{in}/2$ as a reference level.

[0060] Output voltage V_{out} is represented by the following formula:

$$V_{out} = V_{in} \times \{R_2/(R_1 + R_2)\}$$

[0061] where R_1 is a resistance of the first MR element 71, and R_2 is a resistance of the second MR element 72.

[0062] Since output voltage V_{out} varies in accordance with the distributed state of the magnetic polymer elements 12 (e.g., the distribution density, embedded depth, diameter [thickness], length, orientated directions, etc. of the magnetic polymer elements 12), the detected output voltage pattern is peculiar to the object 10. In this embodiment, the magnetic metal powder 14 is preferably powder of a magnetically-soft material having high magnetic permeability (such as Permalloy, Co-based amorphous material, soft ferrite).

[0063] Since the detection signal produced by the magnetic sensor 73 is based on the output ratio between two MR elements 71 and 72, it is not easily affected by the ambient temperature variations or noise. Although the output level of an ordinary magnetic head is dependent upon the moving speed of an object, the processing apparatus 70 of the embodiment, which comprises the

magnetic sensor 73, can produce an output of constant level at all times, without being adversely affected by the moving speed of the object and the ambient temperature variations.

[0063] A magnetic polymer element 12 used in the embodiment may be such an element as is shown in FIG. 10. In the element depicted in FIG. 10, particles of magnetic metal powder 14 are distributed in the entire cross section of an element main body 13 formed of a high molecular material. As in the foregoing embodiment, the high molecular material of the element main body 13 may be a thermoplastic resin, such as polyethylene, polyester, or urethane. In the case where the base member 11 is formed of paper, however, it is preferable that the element main body 13 be formed of acrylic resin. The mixing ratio of the magnetic metal powder 14 is preferably in the range of 30 to 80% by weight. If the mixing ratio is lower than 30% by weight, an output obtained from the magnetic metal powder 14 may not be high enough for practical use. Conversely, if the mixing ratio exceeds 80% by weight, the magnetic polymer elements 12 greatly deteriorate in strength, particularly tensile strength, and cannot be used in practice.

[0064] As is shown in FIG. 11, the magnetic polymer elements 12 are incorporated in the base member 11 formed of paper, such that they are integrally mixed with the wood pulp fibers 80 of the paper and are arranged at random. It should be noted that the magnetic polymer elements 12 can be easily mixed with the wood pulp fibers 80 in that manner in an ordinary paper pulp-manufacturing process.

[0065] In the case where the magnetic polymer elements 12 and the wood pulp fibers 80 are integrally mixed with each other, they are arranged at random and tangled together three-dimensionally. Therefore, the magnetic polymer elements 12 do not change in position inside the base member 11, separate from the base member 11, or form a burr on the surface of the base member 11, so that the state of the magnetic polymer elements is very stable. In addition, since the magnetic polymer elements 12 and the wood pulp fibers 80 are tangled together three-dimensionally, the object cannot be easily forged, and a high degree of security is ensured.

[0066] The magnetic polymer elements 12 can be manufactured by use of the manufacturing device 90 shown in FIG. 12. The manufacturing device 90 comprises an acrylic solution supply section 92 having a nozzle 91 from which an acrylic solution is jetted; and a solution tub 94 containing a coagulating solution 93. As is shown in an enlarged scale in FIG. 13, an acrylic solution containing a large number of magnetic metal powder particles 14 is made to come out from the nozzle 91 and to pass through the coagulating solution 93. As a result, a magnetic polymer element 12 is obtained wherein a large number of magnetic metal powder particles 14 are contained in an element main body 13 formed of acrylic resin. The magnetic polymer element

12 is cut into pieces such that each cut pieces has a length in the range of 2 to 10 mm.

[0067] The cross section of the magnetic polymer elements 12 need not have a circular shape; it may have a rectangular shape, an oval shape, or a polygonal shape. The magnetic polymer elements 12 having such cross sectional shapes can be manufactured by changing the cross sectional shape of the opening of the nozzle 91. If magnetic polymer elements 12 having a flat cross section are manufactured, such magnetic polymer elements can be advantageously incorporated in a thin base member 11.

[0068] Where the element main bodies 13 of the magnetic polymer elements 12 are formed of an acrylic resin, the magnetic polymer elements 12 have a specific gravity approximately equal to that of the wood pulp fibers 80. In this case, the magnetic polymer elements 12 and the wood pulp fibers 80 easily mix with each other in the pulp solution. If the surface of the acrylic resin (i.e., the surface of the magnetic polymer elements 12) is observed by means of a microscope, it can be seen that a large number of small projections are present on the surface. This means that the magnetic polymer elements 12 and the wood pulp fibers 80 are strongly tangled together. In the conventional art, metallic wires are likely to collect in the lower region of the pulp solution, so that the metallic wires cannot be easily mixed with the wood pulp fibers. In addition, since the metallic wires used in the conventional art have a smooth surface, they cannot be strongly tangled with the wood pulp fibers.

[0069] Like the magnetic polymer element 12 shown in FIG. 14, the outer surface of the element 12 may be covered with a coating layer 98 having a similar color to that of the base member 11. Where the base member 11 is white, a white or whitish coating layer 98 is desirable. Such a coating layer can be prepared, for example, by adding titanium oxide 99 to a high molecular material. Where the base member 11 is brown, a brown coating layer 98 is desirable.

[0070] A magnetic polymer element 12 comprising the coating layer 98 mentioned above can be manufactured by means of an acrylic solution supply section 111, such as that shown in FIG. 15. The acrylic solution supply section 111 shown in FIG. 15 comprises a nozzle 110 having a double structure. The acrylic solution 95 containing magnetic metal powder 14 is made to come out into the coagulating solution (FIG. 12), such that the acrylic solution 95 is surrounded by a polymer solution 112 containing titanium oxide 99. In this manner, a magnetic polymer element 12 covered with a coating layer 98 is manufactured.

[0071] It is desirable that the magnetic polymer elements 12 have a length in the range of 2 to 10 mm. If the magnetic polymer elements 12 are shorter than 2 mm, they will be uniformly distributed in the base member, just like powder, and the processing apparatuses 20 and 70 presently available cannot produce an output indicative of to the distribution of the magnetic polymer

elements 12. The output which the presently-available processing apparatuses 20 and 70 can produce from such uniform element distribution will be such as that shown in FIG. 16. If the magnetic polymer elements 12 are, for example, 5 mm in length, the output obtained by the processing apparatuses is indicative of the distribution of the elements 12, as shown in FIG. 17. If the elements 12 are longer than 10 mm, the elements 12 do not easily mix with the wood pulp fibers 80 in the pulp solution, and with the presently-available paper making technology, it is not easy to integrally incorporate such long elements in paper.

[0072] It is desirable that the magnetic polymer elements 12 have a diameter within the range between 10 μm to 100 μm . As can be seen from FIG. 18, magnetic polymer elements 12 having a diameter of 10 μm or greater produces an output of applicable level, as long as they contain a sufficiently large amount of magnetic metal powder 14. The use of magnetic polymer elements having a large diameter is desirable since such elements produce an output of high level. However, if the elements 12 have a diameter greater than 100 μm , part of such elements will be projected from the surface of a paper base member 11 (it is assumed that the thickness of the paper base member is 100 μm or thereabouts). In practice, therefore, the use of magnetic polymer elements 12 having a diameter of 100 μm or greater is not desirable. In short, the diameter of the magnetic polymer elements 12 should be smaller than the thickness of the base member 11.

[0073] A to-be-checked object according to another embodiment of the present invention will now be described with reference to FIGS. 19 through 23. In FIGS. 19-23, the structural elements which are similar to those of the foregoing embodiments are denoted by the same reference numerals as used in the above descriptions, and a detailed description of such elements will be omitted herein.

[0074] The object 10 shown in FIG. 19 comprises a card-like main body 120, and a sign panel 121 provided on part of the obverse or reverse side of the main body 120. The sign panel 121 serves as a scanning region 17. In general, the main body 120 is formed of a synthetic resin, such as polyethylene or vinyl chloride, but it may be formed of paper.

[0075] On the sign panel 121, a certain kind of data (such as the signature of the card owner) is written with a writing tool, such as a ball-point pen or a fountain pen. As is shown in FIGS. 20 and 21, the sign panel 121 is secured to the main body 120 by means of an adhesive 126. The adhesive 126 is a thermoplastic synthetic resin or another kind of adhesive material.

[0076] A code indicator section 18 is provided on the object 10. Information which is peculiar to the object 10 and which is determined by the distribution of the magnetic polymer elements incorporated in the sign panel 121 is encoded and recorded in the code indicator section 18 by means of the processing apparatus 70 shown

in FIG. 9. As is depicted in FIG. 19, the code indicator section 18 is a magnetic strip narrower than the main body 120. Alternatively, it may be a recording medium on which optically-readable data, such as a bar code, a two-dimensional bar code, or an OCR character, is indicated.

[0077] The sign panel 121 comprises a white or whitish base member 11 formed of paper, and a large number of magnetic polymer elements 12 are integrally incorporated in the base member 11 such that they are oriented in many and unspecified directions.

[0078] Each magnetic polymer element 12 is a fibrous element and, as shown in FIG. 10, is made up of an element main body 13 formed of a high molecular material, and magnetic metal powder 14 distributed in the entire cross section of the element main body 13. Acrylic resin is suitable as the material of the high molecular material of the element main body 13, but a thermoplastic resin, such as polyethylene, polyester, or urethane, may be used in place of the acrylic resin. In short, any kind of synthetic resin can be used as the material of the element main body 13, as long as the synthetic resin has appropriate flexibility.

[0079] The magnetic polymer elements 12 can be manufactured by means of the manufacturing device 90 (FIGS. 12 and 13) mentioned above. The mixing ratio of the magnetic metal powder 14 is preferably in the range of 30 to 80% by weight. If the mixing ratio is lower than 30% by weight, an output obtained from the magnetic metal powder 14 may not be high enough for practical use. Conversely, if the mixing ratio exceeds 80% by weight, the magnetic polymer elements 12 greatly deteriorate in strength, particularly tensile strength, and cannot be used in practice. The particle diameter of the magnetic metal powder 14 should be 1 μm or less, and the average particle diameter thereof is preferably within the range of 0.2 to 0.3 μm .

[0080] The sign panel 121 is manufactured by the following steps: the step of preparing a pulp solution in which wood pulp fibers 80 and magnetic polymer elements 12 are mixed with each other; a step of making a sheet-like object from the pulp solution such that the wood pulp fibers 80 and the magnetic polymer elements 12 are tangled together three-dimensionally in the sheet-like object; and a step of cutting the sheet-like object into pieces of desirable size. Through these steps, a sign panel 121 having predetermined size is manufactured. As is shown in FIG. 11, the base member 11 contains a large number of wood pulp fibers 80, and the magnetic polymer elements 12 are integrally mixed with these wood pulp fibers 80.

[0081] A surface member 130 formed mainly of paper may be provided on the surface of the base member 11, as shown in FIGS. 22 and 23. A certain kind of data can be written on the surface member 130, and the surface member 130 serves to conceal the magnetic polymer elements 12 incorporated in the base member 11.

[0082] According to the present invention, the mag-

netic polymer elements 12 can be embedded in the reverse side of the canvas of a painting, and the cipher code mentioned above can be recorded in a code indicator section. These procedures provide a proof that the painting is authentic. According to the present invention, moreover, the magnetic polymer elements 12 can be embedded in a three-dimensional art object, so as to distinguish it from its imitations.

Claims

1. An object to be checked for authenticity, comprising a base member (11) formed of a nonmagnetic material and a scanning region (17) located at a specific portion of the base member (11), wherein a plurality of magnetic elements (12) are scattered at random in the scanning region (17) and oriented in many and unspecified directions; said object further comprising a code indicator section (18) for storing encoded information corresponding to an output which is obtained in accordance with a state of the magnetic elements (12) scattered in the scanning region (17); **characterized in that** said magnetic elements (12) are magnetic polymer elements; and each of said magnetic elements (12) includes a flexible element main body (13) formed of a high molecular material and a magnetic metal contained in the element main body (13). 10
2. The object according to claim 1, **characterized in that** said magnetic metal is powder (14) which is formed of a magnetically-soft material having high magnetic permeability. 15
3. The object according to claim 1, **characterized in that** said magnetic metal is powder (14) which is formed of a magnetically-hard material having high coercive force. 20
4. The object according to claim 1, **characterized in that** said base member (11) is formed of paper containing a plurality of wood pulp fibers (80), said magnetic polymer elements (12) being integrally incorporated in the base member (11) together with the wood pulp fibers (80) of the paper. 25
5. The object according to any one of claims 1 and 4, **characterized in that** the high molecular material of the element main body (13) of the magnetic polymer element (12) is an acrylic resin. 30
6. The object according to any one of claims 1 and 4, **characterized in that** each of said magnetic polymer elements (12) is covered with a coating layer (98) having a similar color to that of the base mem- 35

7. The object according to claim 6, **characterized in that** said base member (11) is white, and said coating layer (98) is a white or whitish coating layer formed of a high molecular material containing titanium oxide. 5
8. A card-like object which is to be checked and which comprises: a card-like main body (120) formed of a nonmagnetic material; and a sign panel (121) located in a scanning region (17) provided on at least part of an obverse or reverse side of the main body (120), a predetermined kind of data being written on the sign panel (121), said sign panel (121) includes a base member (11) formed of paper containing a large number of wood pulp fibers (80); and said card-like main body (120) has a code indicator section (18) for storing encoded information; **characterized in that** a plurality of fibrous magnetic polymer elements (12) are integrally incorporated in the base member (11) together with the wood pulp fibers (80), each of said magnetic polymer elements (12) having an element main body (13) formed of a high molecular material, and magnetic metal powder (14) contained in the element main body (13); and said encoded information corresponds to a detection signal which is obtained in accordance with a state of the magnetic polymer elements (12) of the sign panel (121). 10
9. The card-like object according to claim 8, **characterized in that** said code indicator section (18) includes a magnetically or optically readable recording medium for retaining the encoded information. 15
10. The card-like object according to claim 8, **characterized by** further comprising a coating layer (98) which covers an outer circumference of each of the magnetic polymer elements (12) and which has a similar color to that of the base member (11). 20
11. The card-like object according to claim 10, **characterized in that** said base member (11) is white, and said coating layer (98) is a white or whitish coating layer formed of a high molecular material containing titanium oxide. 25
12. The card-like object according to claim 8, **characterized by** further comprising a surface member (130) formed mainly of paper and provided on the base member (11) of the sign panel (121). 30

Patentansprüche

1. Auf Echtheit zu prüfender Gegenstand, der ein aus einem nichtmagnetischen Material gebildetes Basiselement (11) und eine an einem spezifischen Teil des Basiselements (11) angeordneten Abtastregion umfasst,
wobei eine Mehrzahl von magnetischen Elementen (12) zufällig in der Abtastregion (17) gestreut und in vielen und unspezifizierten Richtungen ausgerichtet sind;
wobei der Gegenstand ferner einen Code-Indikatorabschnitt (18) zum Speichern codierter Information umfasst, die einer Ausgabe entspricht, die in Übereinstimmung mit einem Zustand der in der Abtastregion (17) gestreuten magnetischen Elemente (12) erhalten wird;
dadurch gekennzeichnet, dass
die magnetischen Elemente (12) magnetische Polymerelemente sind; und
jedes der magnetischen Elemente (12) einen flexiblen Elementhauptkörper (13) umfasst, der aus einem hochmolekularen Material und einem in dem Elementhauptkörper (13) enthaltenen magnetischen Metall gebildet ist. 5

2. Gegenstand gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das magnetische Metall ein Pulver (14) ist, das aus einem weichmagnetischen Material mit hoher magnetischer Permeabilität gebildet ist. 10

3. Gegenstand gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das magnetische Metall ein Pulver (14) ist, das aus einem hartmagnetischen Material mit hoher Koerzitivkraft gebildet ist. 15

4. Gegenstand gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Basiselement (11) aus einem Papier gebildet ist, das eine Mehrzahl von Zellstofffasern (80) umfasst, wobei die magnetischen Polymerelemente (12) als Bestandteil in dem Basiselement (11) zusammen mit den Zellstofffasern (80) des Papiers aufgenommen sind. 20

5. Gegenstand gemäß einem der Ansprüche 1 und 4, **dadurch gekennzeichnet, dass** das hochmolekulare Material des Elementhauptkörpers (13) des magnetischen Polymerelements (12) ein Acrylharz ist. 25

6. Gegenstand gemäß einem der Ansprüche 1 und 4, **dadurch gekennzeichnet, dass** jedes der magnetischen Polymerelemente (12) mit einer Überzugsschicht (98) bedeckt ist, die eine ähnliche Farbe wie das Basiselement (11) aufweist. 30

7. Gegenstand gemäß Anspruch 6, **dadurch gekennzeichnet, dass** das Basiselement (11) weiß ist und dass die Überzugsschicht (98) eine weiße oder weißliche Überzugsschicht ist, die aus einem hochmolekularen Material mit Titanoxid gebildet ist. 35

8. Ein zu überprüfender, kartenähnlicher Gegenstand, der umfasst:
einen kartenähnlichen Hauptkörper (120), der aus einem nichtmagnetischen Material gebildet ist; und
ein Zeichen-Panel (121), das in einer Abtastregion (17) angeordnet ist, die mindestens teilweise auf einer Vorder- oder Rückseite des Hauptkörpers (120) vorgesehen ist, wobei eine vorbestimmte Datenart auf das Zeichen-Panel (121) geschrieben ist, wobei das Zeichen-Panel (121) ein Basiselement (11) umfasst, das aus Papier mit einer großen Anzahl von Zellstofffasern (80) gebildet ist; und der kartenähnliche Hauptkörper (120) einen Code-Indikatorabschnitt (18) zum Speichern codierter Information aufweist; 40

dadurch gekennzeichnet, dass
eine Mehrzahl von faserförmigen magnetischen Polymerelementen (12) einstückig in dem Basiselement (11) zusammen mit den Zellstofffasern (80) aufgenommen ist, wobei jedes der magnetischen Polymerelemente (12) einen aus einem hochmolekularen Material gebildeten Elementhauptkörper (13) und in dem Elementhauptkörper (13) enthaltenes magnetisches Metallpulver (14) aufweist; und die codierte Information einem Erfassungssignal entspricht, das in Übereinstimmung mit einem Zustand der magnetischen Polymerelemente (12) des Zeichen-Panels (121) erhalten wird. 45

9. Kartenähnlicher Gegenstand gemäß Anspruch 8, **dadurch gekennzeichnet, dass** der Code-Indikatorabschnitt (18) ein magnetisch oder optisch lesbare Aufzeichnungsmedium zum Halten der codierten Information aufweist. 50

10. Kartenähnlicher Gegenstand gemäß Anspruch 8, ferner **gekennzeichnet durch** Umfassen einer Überzugsschicht (98), die einen äußeren Umfang jedes der magnetischen Polymerelemente (12) bedeckt und die eine ähnliche Farbe wie das Basiselement (11) aufweist. 55

11. Kartenähnlicher Gegenstand gemäß Anspruch 10, **dadurch gekennzeichnet, dass** das Basiselement (11) weiß ist, und die Überzugsschicht (98) eine weiße oder weißliche Überzugsschicht ist, die aus einem hochmolekularen Material mit Titanoxid gebildet ist. 60

12. Kartenähnlicher Gegenstand gemäß Anspruch 8, ferner gekennzeichnet durch Umfassen eines Oberflächenelements (130), das hauptsächlich aus Papier gebildet ist und auf dem Basiselement (11) des Zeichen-Panels (121) vorgesehen ist. 5

Revendications

- Objet dont on doit contrôler l'authenticité comprenant un élément de base (11) constitué d'un matériau non magnétique et d'une région de numérisation (17) située dans une partie spécifique de l'élément de base (11), dans lequel une pluralité d'éléments magnétiques (12) est dispersée aléatoirement dans la région de numérisation (17) et ils sont orientés selon des directions nombreuses et non spécifiées ;
ledit objet comprenant de plus une section indicatrice de code (18) destinée à mémoriser des informations codées correspondant à une sortie que l'on obtient conformément à l'état des éléments magnétiques (12) dispersés dans la région de numérisation (17) ;
caractérisé en ce que 25
lesdits éléments magnétiques (12) sont des éléments en polymère magnétique ;
et
chacun desdits éléments magnétiques (12) comprend un corps principal d'élément flexible (13) constitué d'un matériau de poids moléculaire élevé et d'un métal magnétique contenu dans le corps principal d'élément (13). 30
- Objet selon la revendication 1, **caractérisé en ce que** ledit métal magnétique est de la poudre (14) qui est formée d'un matériau magnétiquement doux possédant une perméabilité magnétique élevée. 35
- Objet selon la revendication 1, **caractérisé en ce que** ledit métal magnétique est de la poudre (14) qui est formée d'un matériau magnétiquement dur possédant une force coercitive élevée. 40
- Objet selon la revendication 1, **caractérisé en ce que** ledit élément de base (11) est constitué de papier contenant une pluralité de fibres de pulpe de bois (80), lesdits éléments en polymère magnétique (12) étant intégralement incorporés dans l'élément de base (11) en même temps que les fibres de pulpe de bois (80) du papier. 45
- Objet selon l'une quelconque des revendications 1 et 4, . **caractérisé en ce que** le matériau de poids moléculaire élevé du corps principal d'élément (13) de l'élément en polymère magnétique (12) est une résine acrylique. 55

6. Objet selon l'une quelconque des revendications 1 et 4, **caractérisé en ce que** chacun desdits éléments en polymère magnétique (12) est recouvert d'une couche de revêtement (98) présentant une couleur similaire à celle de l'élément de base (11). 5

- Objet selon la revendication 6, **caractérisé en ce que** ledit élément de base (11) est blanc et ladite couche de revêtement (98) est une couche de revêtement blanche ou blanchâtre, constituée d'un matériau de poids moléculaire élevé contenant de l'oxyde de titane. 10
- Objet semblable à une carte que l'on doit contrôler et qui comprend : un corps principal semblable à une carte (120) constitué d'un matériau non magnétique ; un panneau indicateur (121) situé dans une région de numérisation (17) prévue sur une partie au moins d'un côté d'observation ou d'un côté opposé du corps principal (120), des données d'une sorte prédéterminée étant écrites sur le panneau indicateur (121),
et ledit panneau indicateur (121) comprend un élément de base (11) constitué de papier contenant un grand nombre de fibres de pulpe de bois (80) ;
ledit corps principal semblable à une carte (120) comporte une section indicatrice de code (18) pour mémoriser des informations codées ;
caractérisé en ce que 20
une pluralité d'éléments en polymère magnétique fibreux (12) est incorporée intégralement dans l'élément de base (11) en même temps que les fibres de pulpe de bois (80), chacun desdits éléments en polymère magnétique (12) comprenant un corps principal d'élément (13) constitué d'un matériau de poids moléculaire élevé et de poudre de métal magnétique (14) contenue dans le corps principal d'élément (13) ; et
lesdites informations codées correspondent à un signal de détection que l'on obtient conformément à un état des éléments en polymère magnétique (12) du panneau indicateur (121). 30
- Objet semblable à une carte selon la revendication 8, **caractérisé en ce que** ladite section indicatrice de code (18) comprend un support d'enregistrement pouvant être lu de façon magnétique ou optique pour conserver les informations codées. 45
- Objet semblable à une carte selon la revendication 8, **caractérisé en ce qu'il** comprend de plus une couche de revêtement (98) qui recouvre une circonférence externe de chacun des éléments en polymère magnétique (12) et qui présente une couleur similaire à celle de l'élément de base (11). 50
- Objet semblable à une carte selon la revendication 8, **caractérisé en ce que** le matériau de poids moléculaire élevé du corps principal d'élément (13) de l'élément en polymère magnétique (12) est une résine acrylique. 55
- Objet semblable à une carte selon la revendication 11. Objet semblable à une carte selon la revendication

10, caractérisé en ce que ledit élément de base (11) est blanc et ladite couche de revêtement (98) est une couche de revêtement blanche ou blanchâtre constituée d'un matériau de poids moléculaire élevé contenant de l'oxyde de titane. 5

12. Objet semblable à une carte selon la revendication 8, caractérisé en ce qu'il comprend de plus un élément de surface (130) constitué principalement de papier et prévu sur l'élément de base (11) du panneau indicateur (121). 10

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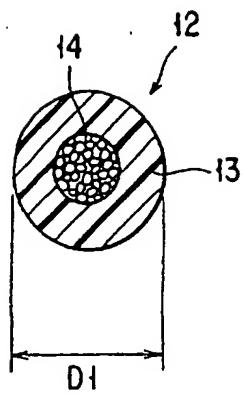


FIG. 1

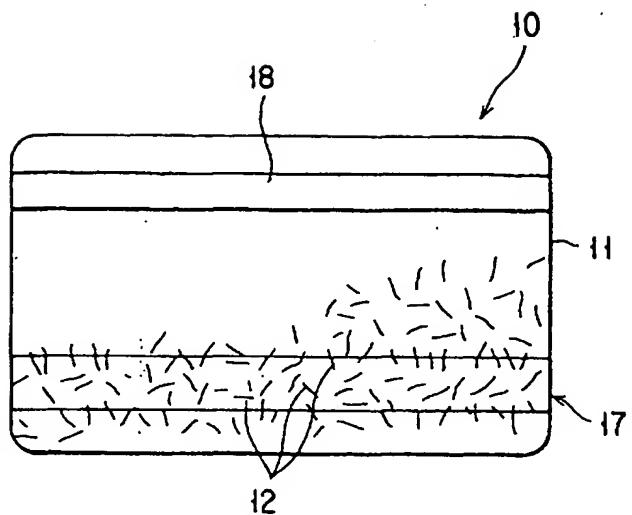


FIG. 2

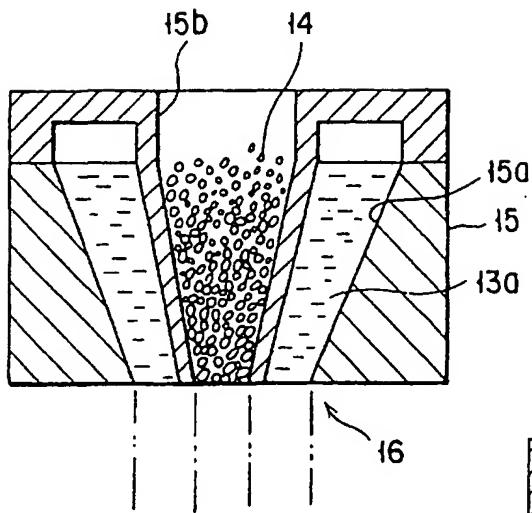


FIG. 3

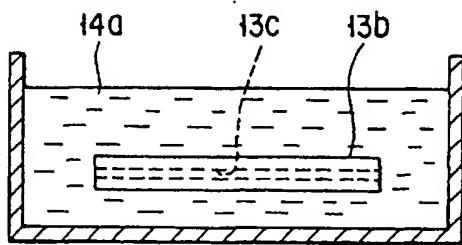
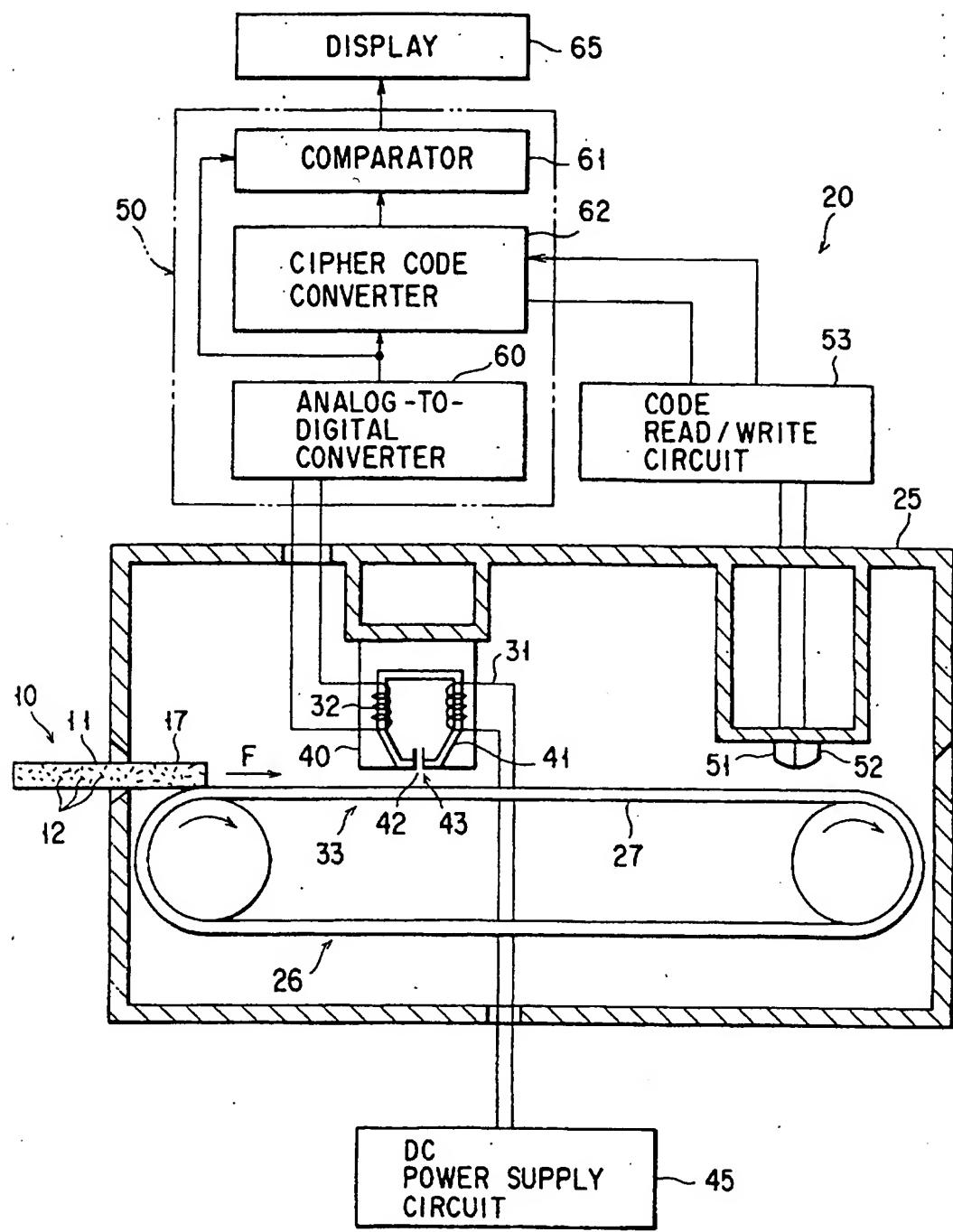
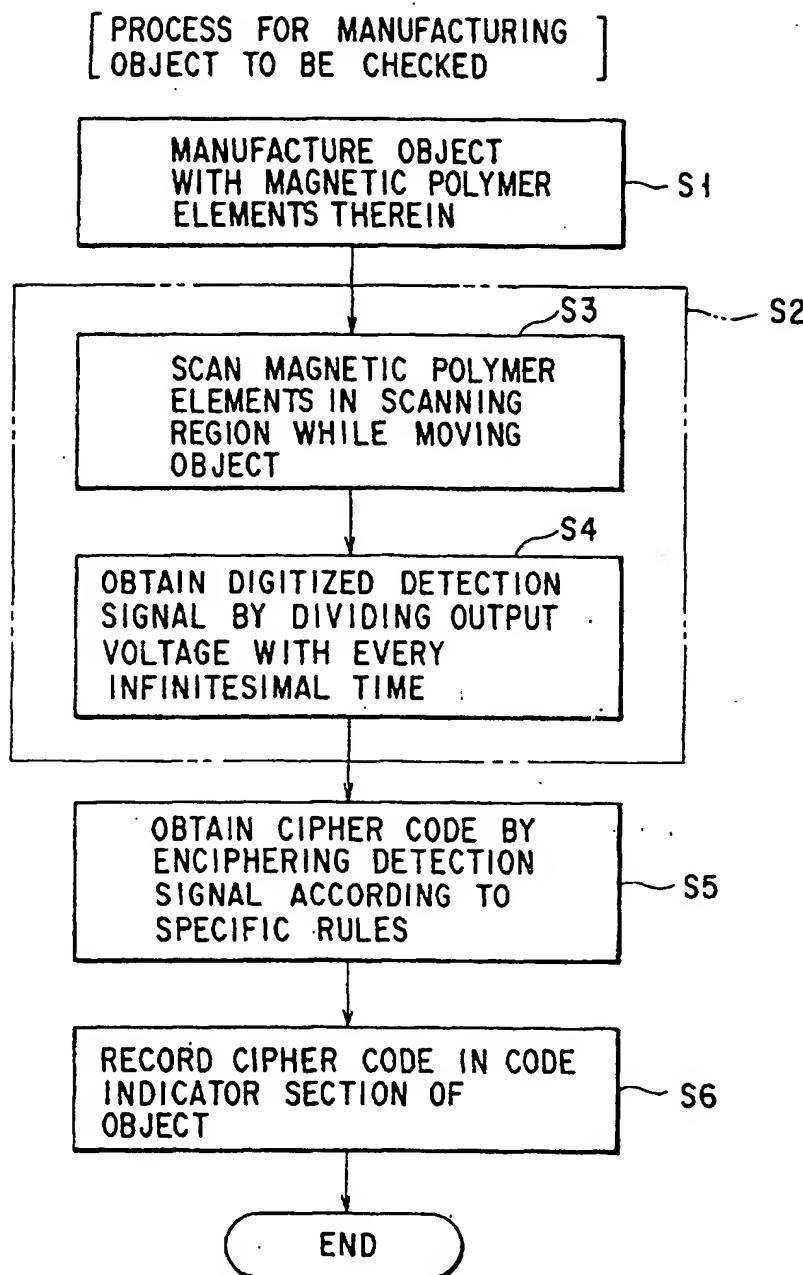


FIG. 4



F I G. 5



F I G. 6

[PROCESS FOR COLLATING]
OBJECT TO BE CHECKED

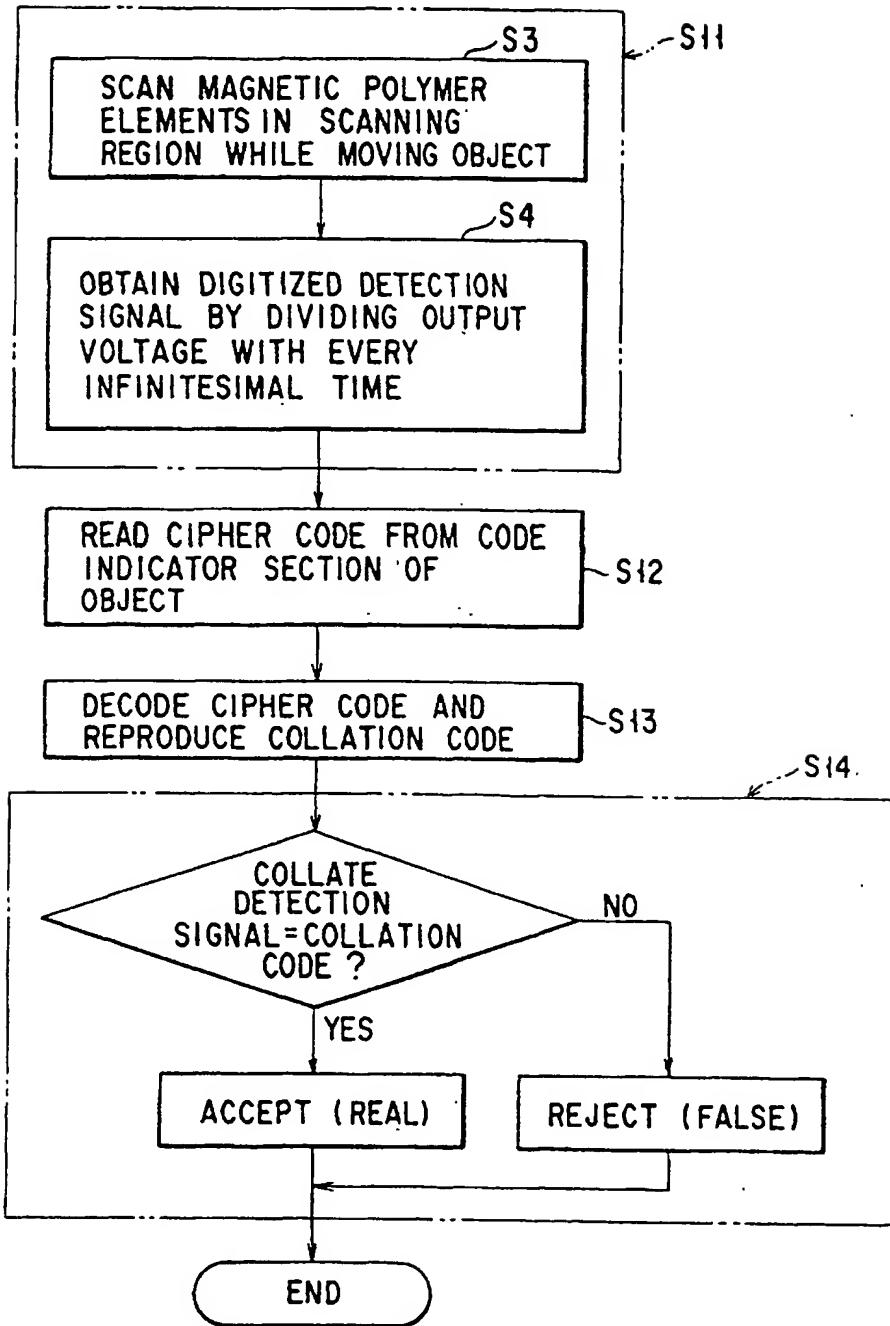


FIG. 7

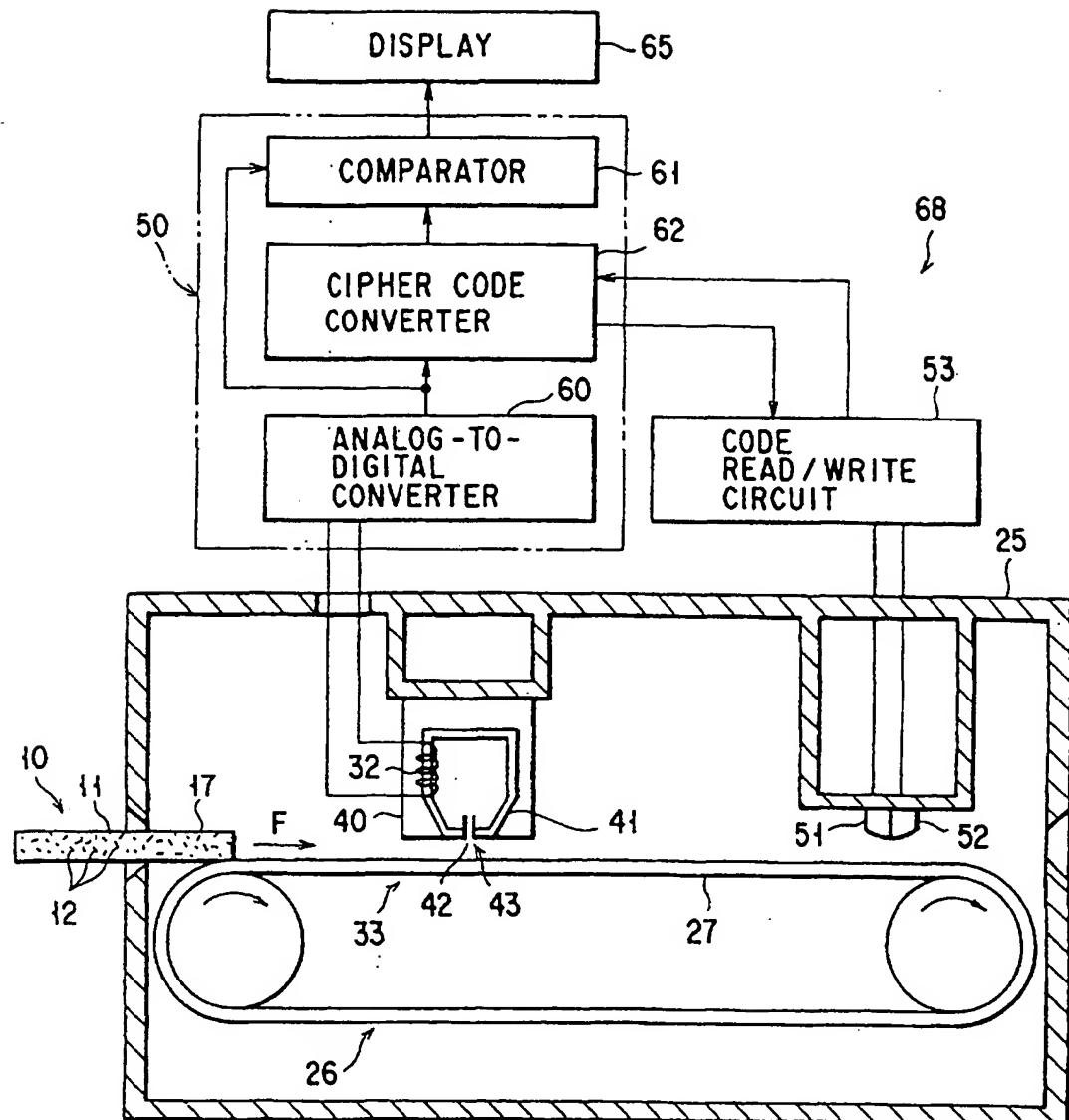
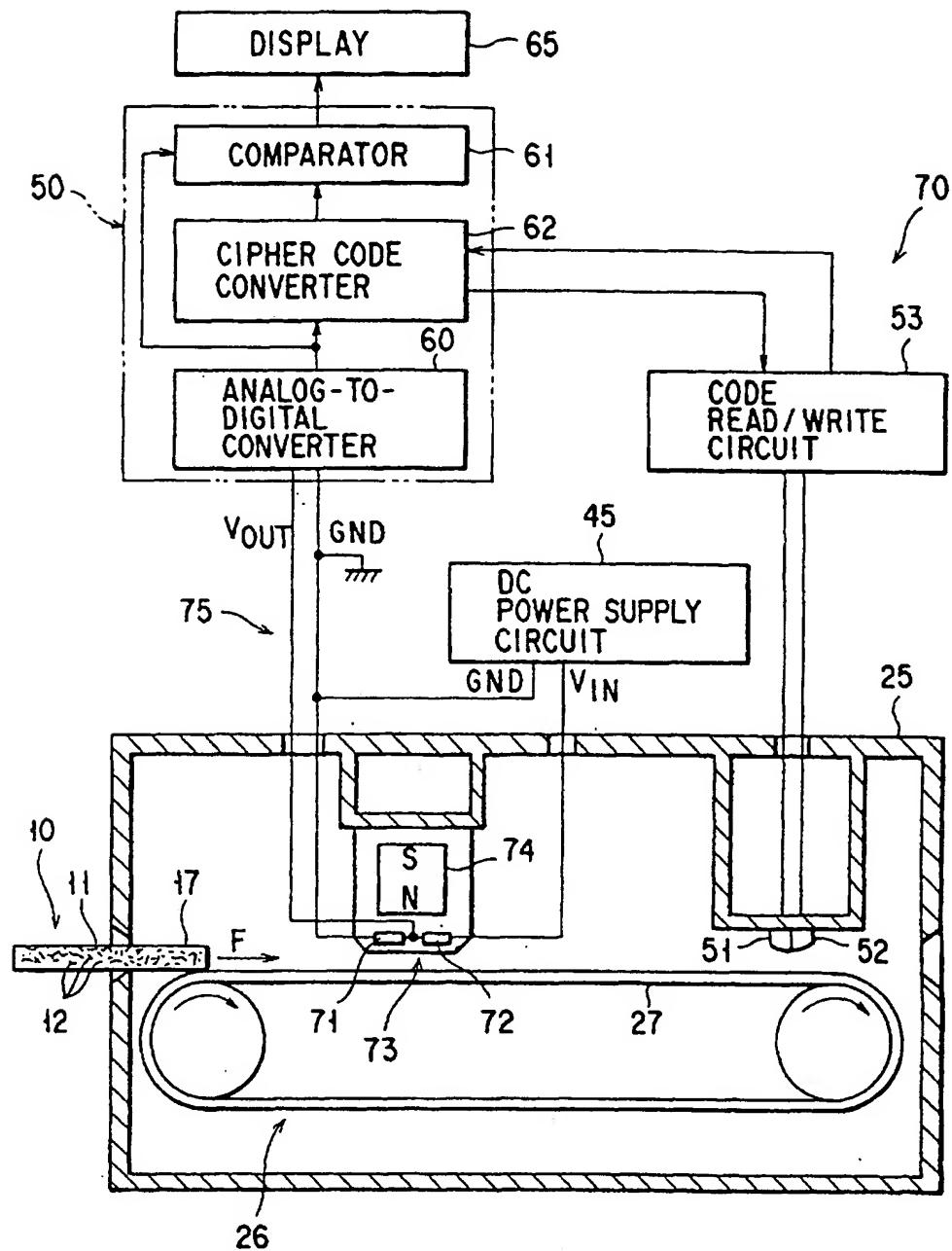


FIG. 8



F I G. 9

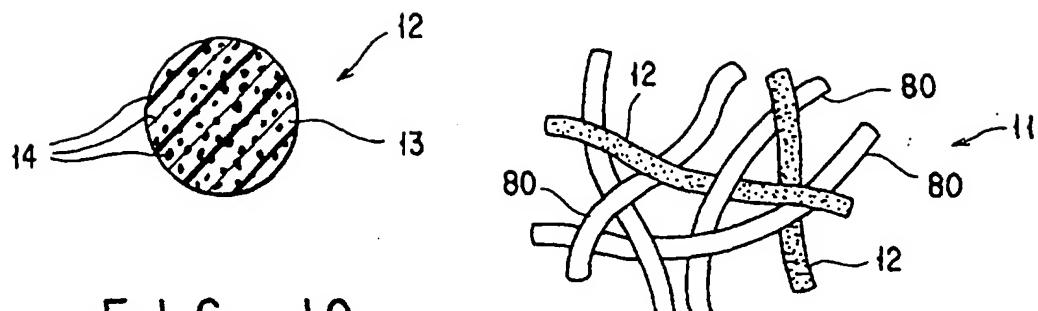


FIG. 11

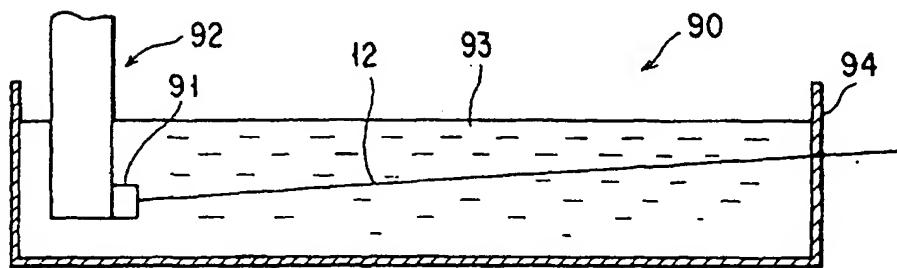


FIG. 12

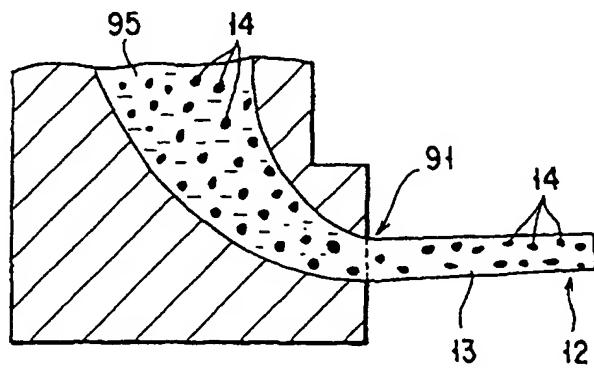


FIG. 13

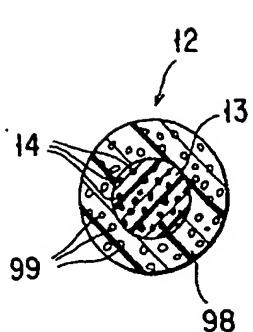


FIG. 14

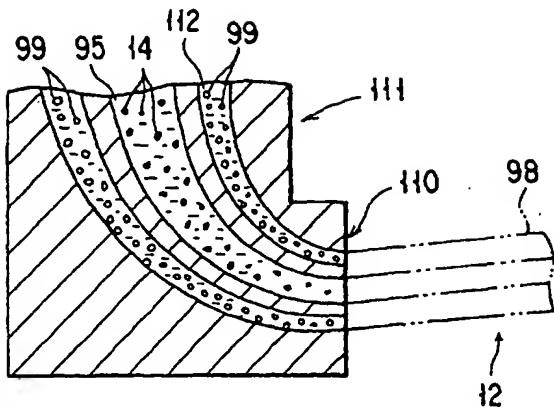


FIG. 15

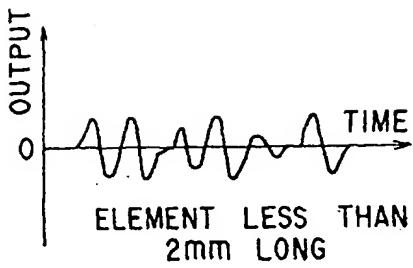


FIG. 16

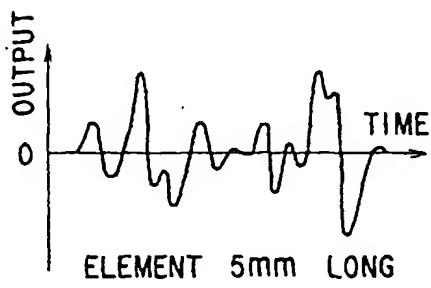


FIG. 17

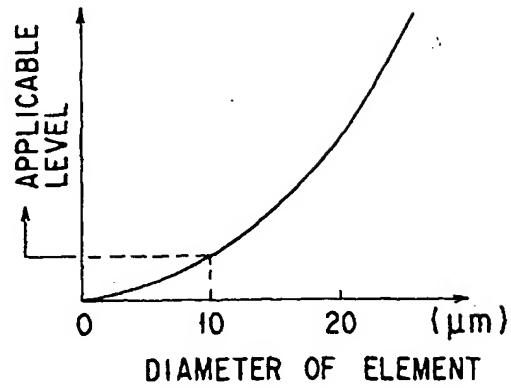


FIG. 18

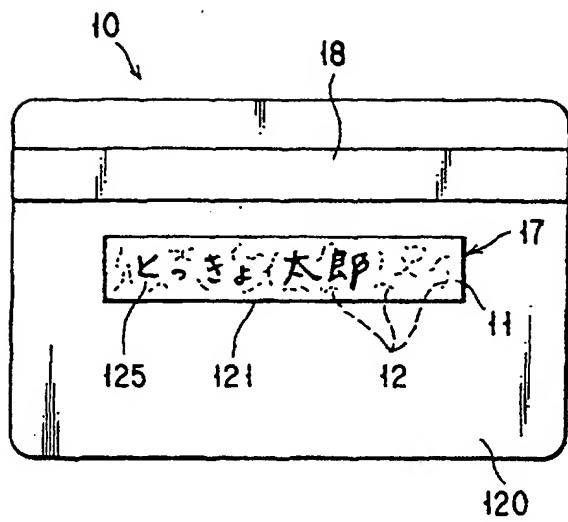


FIG. 19

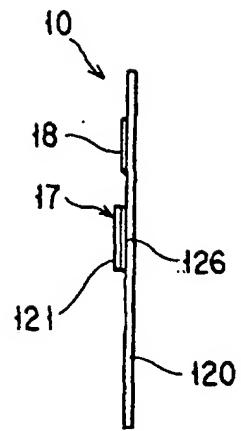


FIG. 20

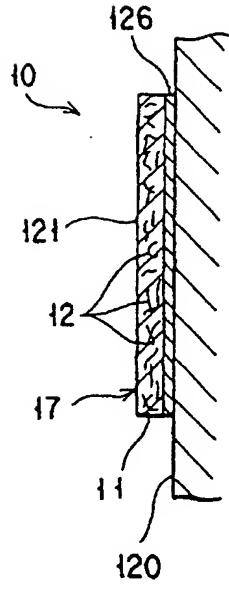


FIG. 21

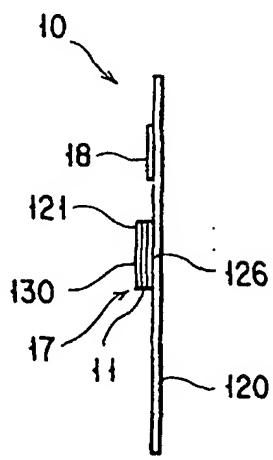


FIG. 22

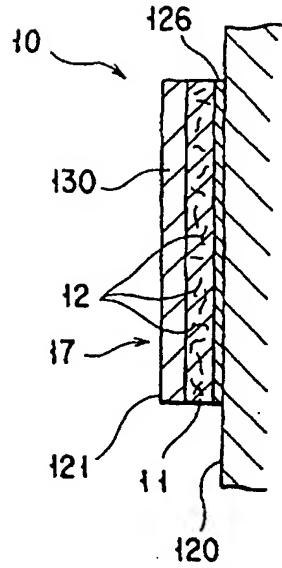


FIG. 23

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